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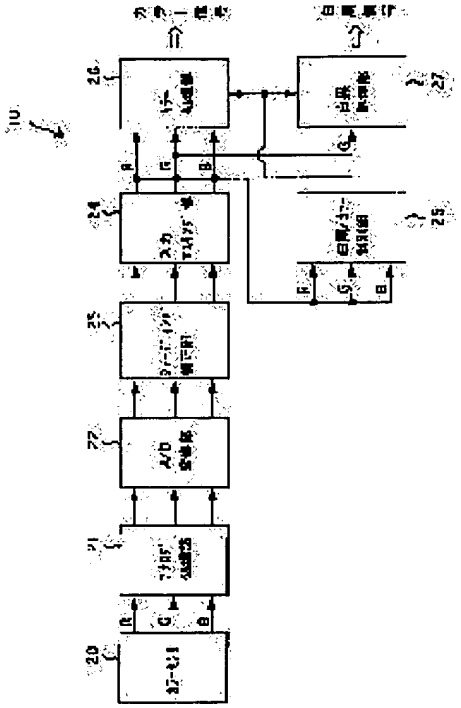
(71)Applicant : **MURATA MACH LTD**
(72)Inventor : **INOUE SHINJI**

(54) IMAGE PROCESSING UNIT, IMAGE PROCESSING METHOD, AND RECORD MEDIUM RECORDING IMAGE PROCESSING PROGRAM

(57)Abstract:
PROBLEM TO BE SOLVED: To improve a processing efficiency of a black/white image by accurately discriminating a color image from the black/white image, and accurately discriminating the black/white image including a medium tone component and the black/white image not including it and using only the image not including the medium tone component as the black/white image.
SOLUTION: The processing unit is provided with a read section 10 that obtains plural color signal data (RGB) from each pixel of an image and a color.black/white image discrimination section 25 of the read section 10 discriminates the image to be a black/white image not including a medium tone image when a gradation level difference of each of color signal data (RGB) is ≤ a prescribed value and a mean value of gradation levels of each of the color signal data (RGB) is ≤ a 1st threshold level or ≥ a 2nd threshold level that is higher than the 1st threshold level in the all pixels of the image.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the record medium which recorded the image-processing method used with the image processing system applied to color facsimile equipment etc., and this equipment, and the image-processing program which performs this method.
[0002]
[Description of the Prior Art] That as for which a color picture is read and made to the latest facsimile apparatus and latest reproducing unit (copy machine) is developed, and the need is increasing with the spread of the color printer of high performance, color displays, etc. In this kind of image processing system, generally, by the optical color sensor, the image corresponding to each of light in three primary colors (RGB) is read, these are mixed, and a color picture is formed.
[0003] And if it is facsimile apparatus, it will encode and will transmit to other facsimile apparatus, and if it is a copy machine, color printing of the data of the formed color picture is carried out from the printer at the recording paper.
[0004]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional image processing system, since the same image processing as a color picture was performed even if it reads monochrome image, the amount of data became huge, and the are recording effectiveness to memory worsened, and the communication link time amount at the time of facsimile transmission was also long. for example, full color in a color picture, when the manuscript of A4 size is read by resolution 200dpi -- if a color is expressed by 8 bits, even if compressible [by about 1/20] (coding) by JPEG etc., the amount of data is set to about 500KB, and if it compresses with MH or MR sign after binary-izing, the amount of data will be set to several 10KB by one monochrome image.
[0005] Moreover, even if it was monochrome image, when the halftone expression of the image including a photograph etc. is carried out by an error diffusion method etc., compression may seldom be unable to be expected depending on an image. This invention is made in view of such a situation, and distinguish a color picture and monochrome image correctly, and monochrome image which contained the halftone portion even if it was monochrome image, and monochrome image which is not included are distinguished correctly. Only the image which does not contain a halftone portion is used as monochrome image, and it aims at offering the record medium which recorded the image processing system, the image-processing method, and image-processing program which gathered the processing effectiveness at the time of being monochrome image.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in an image processing system concerning claim 1 of this invention It has a read station which obtains two or more chrominance-signal data from each pixel of an image. This read station In all pixels of an image, a gradation level difference of each chrominance-signal data is below a predetermined value. And when the average of gradation level of each chrominance-signal data is the 1st less than threshold or it is the 2nd larger more than threshold than this 1st threshold, it is characterized by judging that image to be monochrome image which does not contain a halftone image.
[0007] Here, I hear that gradation level of each chrominance-signal data is almost equal to a gradation level difference of each chrominance-signal data being below a predetermined value here as the 1st condition, and it is shown. For example, if chrominance-signal data is three kinds of RGB and the three gradation level is equal, the pixel does not have coloring and it is shown that it is the pixel of an achromatic color which can be gradually expressed only by lightness from white to black.
[0008] Moreover, it is shown by fulfilling the 1st condition of the above as the 2nd condition, as the average of gradation level of each chrominance-signal data is the 1st less than threshold that the pixel is a black pixel and the pixel is a white pixel as the average of each gradation level is the 2nd larger more than threshold than the 1st threshold. Therefore, if both conditions are fulfilled, the image can be judged to be monochrome image which does not contain a halftone image (gray level).
[0009] In addition, a chrominance signal which a read station acquires is CIE of CMYK (cyanogen, MAZENDA, yellow, black) of a subtraction system, and a color vision system, although RGB (red, green, blue) which is the expression of a color of an addition system is common. You may be data signals, such as XYZ. In claim 2, an image-processing method currently used with an image processing system according to claim 1 is proposed. That is, by this image-processing method, two or more chrominance-signal data is read in each pixel of an image, and in all pixels of that image, when a gradation level difference of each chrominance-signal data is below a predetermined value, the average of gradation level of each chrominance-signal data is the 1st less than threshold or it is the 2nd larger more than threshold than this 1st threshold, that image is processed as a monochrome image which does not contain a halftone image.
[0010] Moreover, in claim 3, a record medium which recorded an image-processing program for performing an image-processing method according to claim 2 is proposed. That is, this record medium is read with an image processing system according to claim 1, and an image processing is henceforth performed according to a program. In addition, ROM besides a floppy disk or an optical disk and a hard disk are also contained in a record medium.
[0011]
[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained with a drawing. Drawing 1 is the block diagram having shown the configuration of an image processing system. Although the configuration of color facsimile equipment F is here shown as one of the image processing systems, this invention is not limited to this and applied to a color copier, an image scanner, etc.
[0012] CPU1 not only controls each part of this facsimile apparatus F, but performs the communication procedure of facsimile. An image

memory 2 stores data, such as facsimile communication, temporarily. ROM3 has memorized beforehand the program which controls actuation of this facsimile apparatus F. RAM4 memorizes temporary data generated at the time of activation of processing, and also memorizes a partner's facsimile number (telephone number) etc. beforehand.
[0013] The data-medium read station 5 reads an image-processing program in the record media fd, such as a floppy disk. The read program is performed by CPU1 with the program beforehand memorized by ROM3. A modem 6 performs the modulation of a signal, and a recovery for facsimile communication. NCU7 performs closing of a communication line L (analog network), and disconnection. In addition, when connecting digital channels, such as an ISDN circuit, it has the ISDN interface connected with a modem 6 instead of NCU7 at DSU.
[0014] The image codec 8 encodes / decrypts a color picture with coding methods, such as JPEG and JBIG, while encoding / decrypting monochrome binary image, with coding methods, such as MH and MR. In addition, when encoding a color picture, the chrominance-signal data of RGB is changed into the data of an XYZ color system, and after being changed into the data of a Lab color coordinate system, the above-mentioned coding is carried out further.
[0015] A control panel 9 consists of actuation means to perform various input setup to this facsimile apparatus F, such as various keys, and display means to display operating state, operating procedure, etc. of this facsimile apparatus F, such as a liquid crystal display and LED. A read station 10 reads a color picture in the set manuscript. That is, two or more chrominance-signal data called RGB has been obtained from each pixel of an image. The Records Department 11 consists of color printers, and records the data received from other facsimile apparatus etc., and the data read in the read station 10 on the recording paper (printout).
[0016] Once it encodes by the image codec 8 and stores in an image memory 2 the image data read in the read station 10 by actuation of a control panel 9, while it transmits through a communication line L, one by one, this facsimile apparatus F once stores in an image memory 2 the image data which received through the communication line L, and it makes the basic actuation which carries out a printout from the Records Department 11, decoding by the image codec 8.
[0017] If it judges that this invention has the feature in processing by the read station 10, and the read image consists of only monochrome images, compared with a color picture, the amount of coded data can be sharply reduced by performing monochrome binary-ized processing. The block diagram shows the configuration of a read station 10 to drawing 2 . the inside of drawing, and 20 -- the three primary colors (RGB) of light -- the optical color sensor which reads the same image by a unit of 3 times independently -- The analog processing section which processes the chrominance signal which 21 read as an analog signal, the A/D-conversion section which 22 makes a digital signal the inputted analog signal, and is outputted, and 23 amend shading distortion and RF distortion. The shading compensation section for obtaining image data without the lighting unevenness of the light source, the sensitivity unevenness of a sensor 20, etc., The input masking section in which 24 amends chrominance-signal data (RGB) according to the property of a sensor 20, Black and white / color distinction section which distinguishes monochrome image whose 25 is the feature of this invention, and a color picture, and 26 and 27 are the color processing sections and monochrome processing sections which perform processing to each image based on the distinction result of black and white / color distinction section 25, respectively.
[0018] The chrominance-signal data read by the color sensor 20 After a shading compensation and input masking are performed as a digital signal, in black and white / color distinction section 25 When it is distinguished whether it is monochrome image or it is a color picture and it is distinguished from a color picture Usually, after passing and changing the expression of a color into a CMYK method from a RGB method by the color processing section 26 It is made the color signal of a multiple value by an error diffusion method etc., and facsimile transmission is carried out, after carrying out a printout as a color picture from the Records Department 11 or encoding by the image codec 8.
[0019] On the other hand, when distinguished from monochrome image, it considers as binary-ized data in monochrome processing section 27, and after the image codec 8 encodes, facsimile transmission is carried out, or a printout is carried out as a monochrome image from the Records Department 11. In addition, although monochrome processing section 27 is considering as the object of processing of only G signal, it is not limited to this and is good by a diagram also considering the AND of other signals and the signal of plurality (2 or 3) as the object.
[0020] As for black and white / color distinction section 25, the image distinguishes whether it is monochrome image based on the chrominance-signal data of all the pixels of a predetermined image. When the gradation level difference of each chrominance-signal data of each pixel is below a predetermined value, the average of the gradation level of each chrominance-signal data is the 1st less than threshold or it is the 2nd larger more than threshold than this 1st threshold, specifically, that image is judged to be monochrome image which does not contain a halftone image.
[0021] In addition, although there are an image of a manuscript unit (two or more pages), an image of a page unit, etc. as predetermined image, if a throughput, an actual use gestalt, etc. are taken into consideration, it is appropriate to judge image classification (black and white/color) per page. It is shown here that the gradation level of each chrominance-signal data is almost equal as the gradation level difference of each chrominance-signal data is below a predetermined value, i.e., the pixel is a pixel of the achromatic color which can be gradually expressed by white without coloring to black.
[0022] Moreover, it is shown by fulfilling the conditions of the above-mentioned achromatic color as the average of the gradation level of each chrominance-signal data is the 1st less than threshold that the pixel is a black pixel and the pixel is a white pixel as the average is the 2nd larger more than threshold than the 1st threshold. Therefore, if both conditions are fulfilled, the image can be judged to be monochrome image which does not contain a halftone image (gray level).
[0023] It is as follows when these conditions are expressed with a formula.
[0024]
[Equation 1]

$$\left|R-\frac{R+G+B}{3}\right|<k \quad \text{and}$$

$$\left|G-\frac{R+G+B}{3}\right|<k \quad \text{and}$$

$$\left|B-\frac{R+G+B}{3}\right|<k$$

[0025]
[Equation 2]

$$\frac{R+G+B}{3} < \alpha \quad \text{or}$$

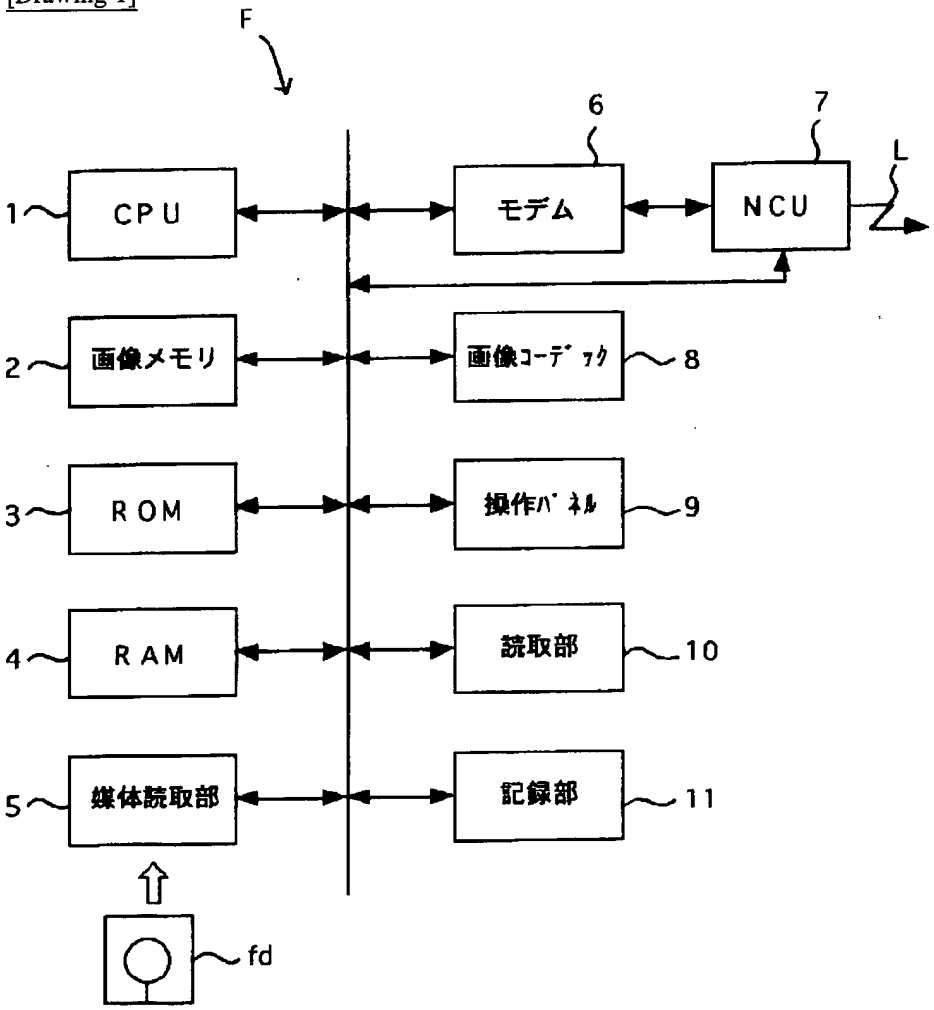
$$\beta < \frac{R+G+B}{3}$$

[0026] With the formula 1, when the absolute value of the difference of the gradation level value and average value of each chrominance-signal data is below a predetermined value (k), it has judged that there is almost no gradation level difference of each chrominance-signal data. Therefore, it is an ideal that a predetermined value (k) is a positive-number value near "0." On the other hand, with the formula 2, it has judged whether the average of the gradation level value of each chrominance-signal data is smaller than the 1st threshold (alpha) used as the decision criterion of a black pixel, or the average of the gradation level value of each chrominance-signal data is larger than the 2nd threshold (beta) used as the decision criterion of a white pixel.
[0027] That is, by both formulas, the gradation level value of each chrominance-signal data is almost the same, and it has judged that the value is one of monochrome values. Next, a formula 2 is explained using drawing 3 . For example, if it is the case where A-A' Rhine of monochrome image as shown in (a) is read, gradation distribution of each RGB at that time comes to be shown in (b). Here, gradation level is divided into 256 steps of 0-255, and if a white portion is read, and the gradation level value reads the value 230, and a black material portion, the gradation level value will turn into the value 20. Therefore, the 1st threshold (alpha) in a formula 2 should just set a little larger value than 20 and the 2nd threshold (beta) as the value a little smaller than 230 in this case.
[0028] Drawing 4 shows the example of circuitry in case black and white / color distinction circuit 25 calculates the two above-mentioned formulas in hard. For this reason, it has the comparators 25c, 25d, and 25e for performing the comparison with division circuit 25a for computing the average of the gradation level value of RGB, subtractor-circuit 25b which searches for a gradation level difference, and each threshold (k, alpha, beta) etc. A distinction signal (they are "1" and a color picture for example, about monochrome image "0") is outputted from the inputted chrominance signal by such configuration. In addition, subtractor-circuit 25b shows performing three operations in a formula 1.
[0029] Moreover, drawing 5 is the flow chart (100-105) which showed the case where above-mentioned black and white / color distinction circuit 25 were calculated in software. Here, whenever it fulfills the conditions of a formula 1 and a formula 2, all the pixels of all the scanning lines for 1 page distinguish the image of the page from monochrome image, and shift to processing of monochrome processing section 27 (104). In addition, step 100 shows that three operations in a formula 1 are performed also here.
[0030] In addition, by the data-medium read station 5, the image-processing program for performing such an image-processing method is read in a record medium fd, and has come be made. By this, an image processing system only reads this program, and, in addition to the processing facility of the conventional color picture, can equip a read station 10 with the function of black and white / color distinction section 25, and monochrome processing section 27.
[0031]
[Effect of the Invention] If each pixel fills the following two conditions with the image processing system of this invention according to claim 1 based on the chrominance-signal data of all the pixels of the read image so that he can understand also from the above explanation, the image will be judged to be monochrome image which does not contain a halftone image. The 1st condition is that the gradation level difference of each chrominance-signal data is below a predetermined value, and is that the average of the gradation level of each chrominance-signal data is the 1st less than threshold, or the 2nd condition is the 2nd larger more than threshold than this 1st threshold. That is, the gradation level of each chrominance-signal data is almost the same, and if the level is the level of either a white pixel or a black pixel, it will judge with monochrome image.
[0032] Thus, if it can judge with monochrome image, compared with the case where it processes as a usual color picture, the amount of data can be decreased sharply, for this reason, the are recording effectiveness to memory can be raised, communication link time amount can be shortened at the time of facsimile transmission, and communication link costs can be saved. By the image-processing method according to claim 2, simply, monochrome image can be extracted out of a color picture, and subsequent processing effectiveness can be raised.
[0033] Moreover, since the image-processing program for performing the image-processing method of claim 2 is recorded on the record medium according to claim 3, when an image processing system is equipped with the function which distinguishes a color picture and monochrome image and it distinguishes from monochrome image only by reading this record medium, that processing effectiveness can be sharply raised compared with a color picture.

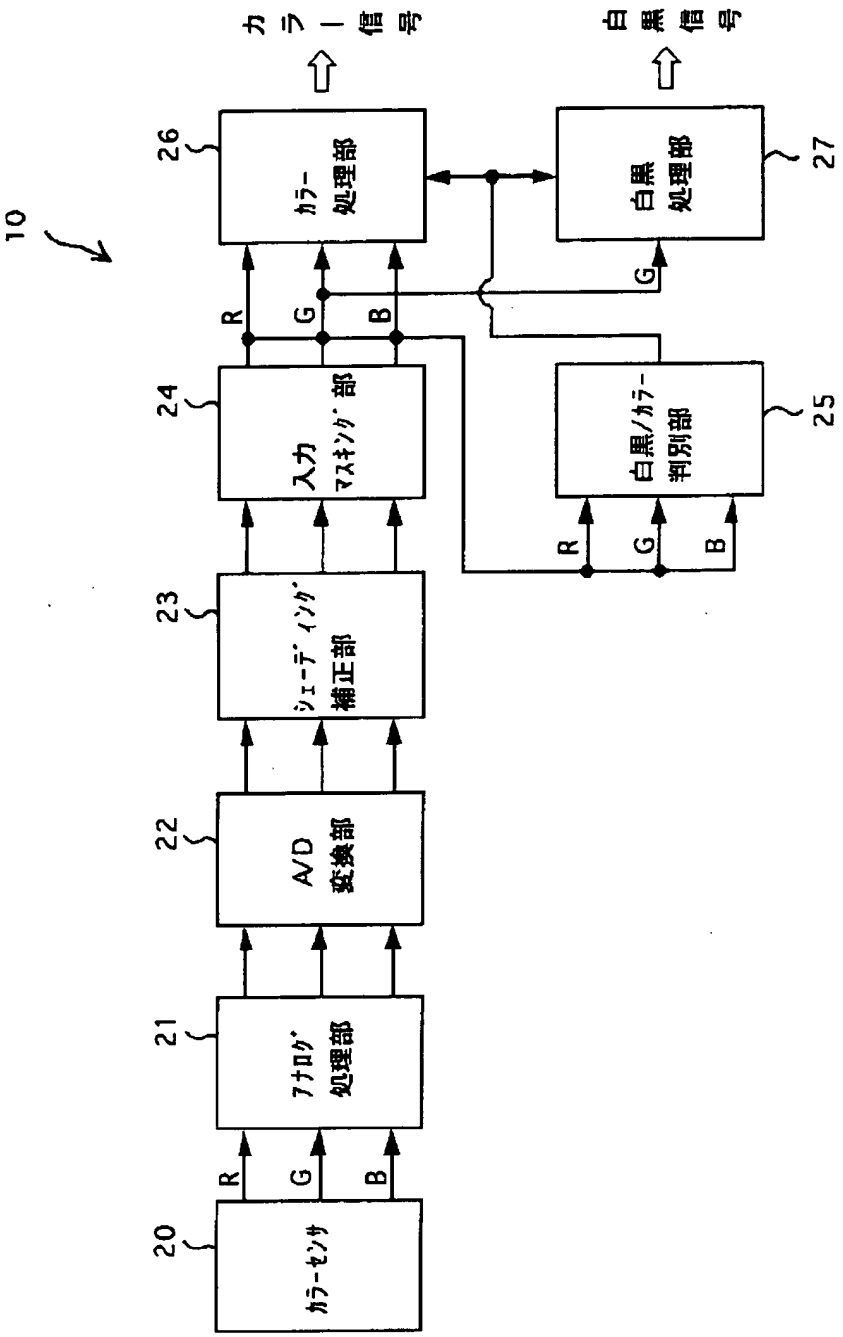
[Translation done.]

DRAWINGS

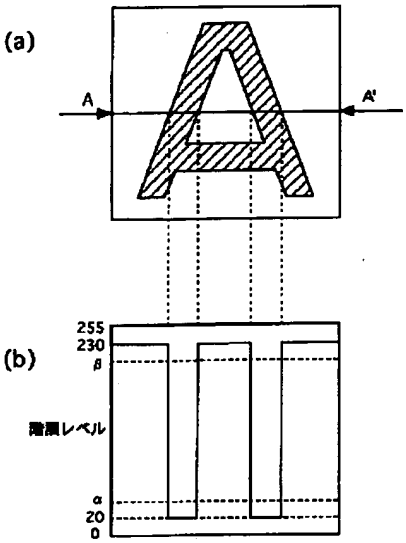
[Drawing 1]



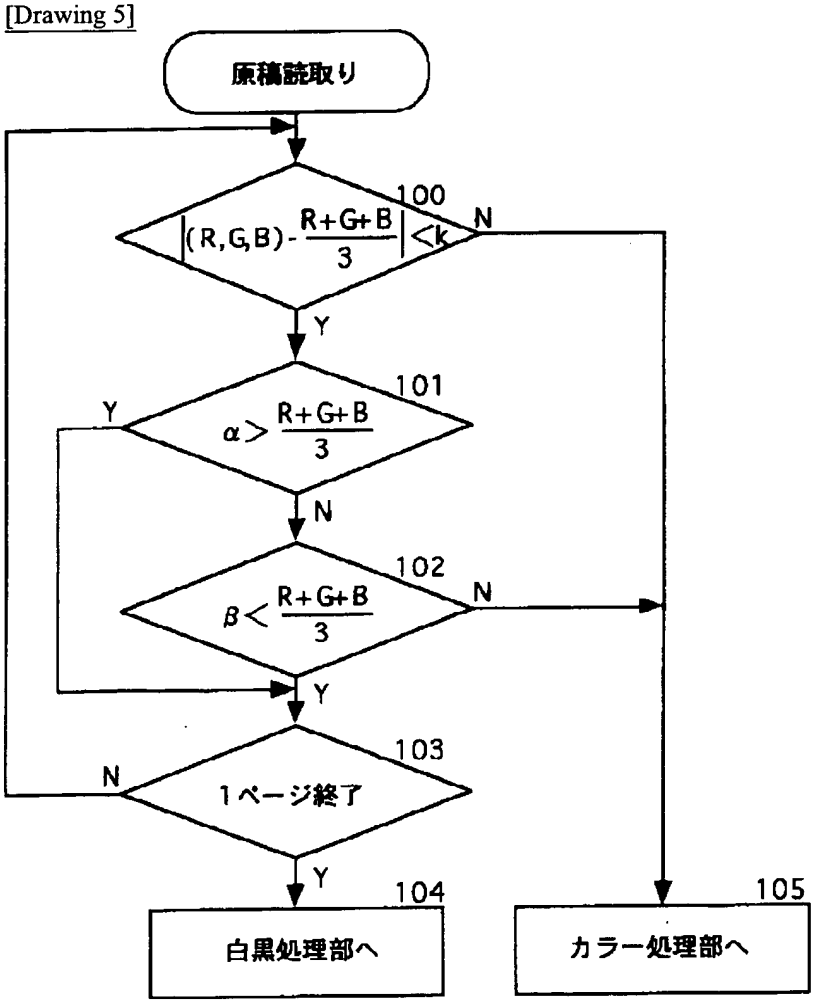
[Drawing 2]


10
20
カラーセンサ
21
アナログ処理部
22
A/D変換部
23
シェーディング補正部
24
入力マスキング部
25
白黒/カラー判別部
26
カラー処理部
27
白黒処理部
R
G
B
カラー信号
白黒信号

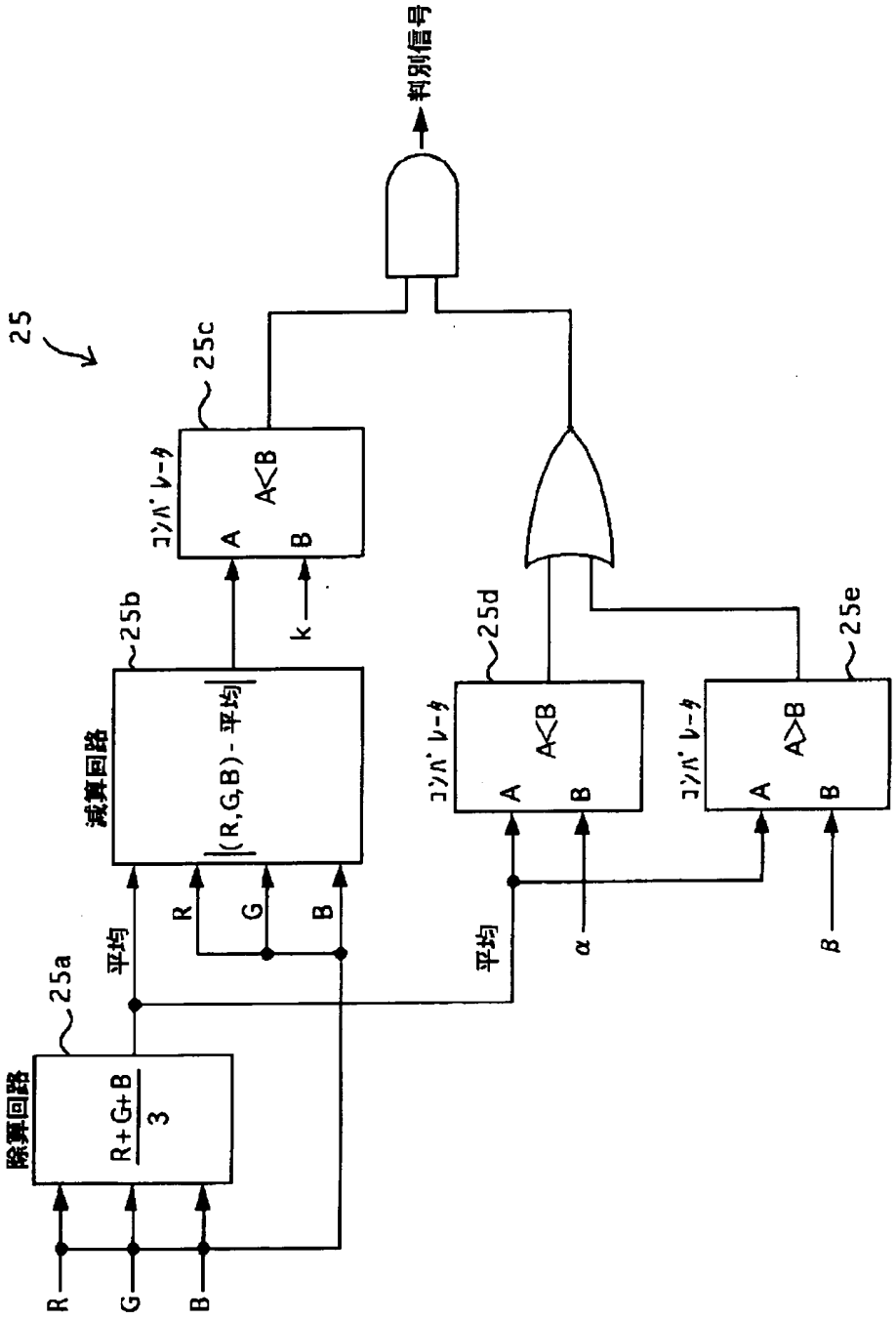
[Drawing 3]



[Drawing 5]



[Drawing 4]



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